

Having described the invention, I claim:

1. An apparatus for insertion into a body lumen, said apparatus comprising:

an elongate member having proximal and distal ends, said distal end being insertable into the body lumen;

at least one clamping arm including a first end having a pivotal connection with said distal end of said elongate member, said pivotal connection providing pivotal movement of said at least one clamping arm relative to said elongate member, said at least one clamping arm extending away from said pivotal connection toward said proximal end of said elongate member; and

control means for controlling the pivotal movement of said at least one clamping arm relative to said elongate member, said control means being operatively connected with said at least one clamping arm.

2. The apparatus of claim 1 wherein said at least one clamping arm is pivotal relative to said elongate member from a closed position in which said at least one clamping arm adjoins said elongate member to an open position in which said at least one clamping arm is pivoted away from said elongate member.

3. The apparatus of claim 2 wherein said at least one clamping arm has a second end opposite said first end, said second end being movable away from said elongate member when said at least one clamping arm pivots from said closed position to said open position.

4. The apparatus of claim 2 wherein said at least one clamping arm when in said open position forms a receptacle for receiving an object, said receptacle being formed between said at least one clamping arm and said distal end of said elongate member, said receptacle facing towards said proximal end of said elongate member.

5. The apparatus of claim 4 wherein said object comprises a stent for delivery into the body lumen.

6. The apparatus of claim 4 wherein said object comprises a foreign object that is undesirably lodged in the body lumen.

7. The apparatus of claim 4 wherein said object comprises a tissue sample for retrieval from the body lumen.

8. The apparatus of claim 4 wherein said at least one clamping arm includes a plurality of teeth for helping to grip the object, said row of teeth facing toward said elongate member.

9. The apparatus of claim 8 wherein said elongate member includes a plurality of teeth located at said distal end of said elongate member and facing toward said at least one clamping arm, said plurality of teeth being for helping to grip the object.

10. The apparatus of claim 2 further comprising a spring at said distal end of said elongate member, said spring biasing said at least one clamping arm toward said open position.

11. The apparatus of claim 1 wherein said at least one clamping arm comprises first and second clamping arms disposed on opposite sides of said elongate member.

12. The apparatus of claim 2 wherein said at least one clamping arm comprises a first cup portion having a concave first receiving portion, said distal end of said elongate member comprising a second cup portion having a concave second receiving portion, said first and second receiving portions facing each other and forming between them a receptacle for receiving an object, said first and second cup portions being closable to close said receptacle when said at least one clamping arm is in said closed position.

13. The apparatus of claim 12 wherein said at least first and second cup portions each include a peripheral rim portion, at least one of said peripheral rim portions comprising a cutting edge.

14. The apparatus of claim 1 wherein said pivotal connection is located at a terminal end of said distal end of said elongate member.

15. The apparatus of claim 1 wherein said control means comprises a control mechanism disposed at said proximal end of said elongate member and connecting means for connecting said control mechanism with said at least one clamping arm.

16. The apparatus of claim 15 wherein said connecting means comprises a cable that extends through a portion of said elongate member.

17. The apparatus of claim 15 wherein said control mechanism includes releasable locking means operatively coupled with said connecting means and for locking said at least one control arm against pivotal movement relative to said elongate member.

18. The apparatus of claim 1 further comprising a positioning mechanism for supporting said elongate member and facilitating insertion of said elongate member into the body lumen, said positioning mechanism comprising:

an outer frame supportable relative to the body lumen;

an inner frame connected to said outer frame, said inner frame being rotatable about a first axis relative to said outer frame; and

an advance assembly connected to said inner frame, said advance assembly being pivotable about a second axis relative to said inner frame, said second axis extending perpendicular to said first axis, said advance assembly comprising a sleeve for receiving said elongate member and advancing means operative to impart advancement of said elongate member in opposite directions along a longitudinal axis of said elongate member.

19. The apparatus of claim 18 wherein said advance assembly further comprises first and second clamping members that form said sleeve for receiving said elongate member, said advance assembly further comprising a locking mechanism operative to place said advance assembly in a locked condition wherein said clamping members clamp onto said elongate member to fix the position of said elongate member relative to said advance assembly, said locking mechanism being further operable to place said advance assembly in an advancing condition wherein said elongate member is released for movement relative to said advance assembly along said longitudinal axis of said elongate member.

20. The apparatus of claim 18 wherein said advancing means comprises a rack and pinion gear set for imparting movement of said elongate member along said longitudinal axis, said rack and pinion gear set comprising a series of rack teeth arranged along an outer surface of said elongate member and a pinion gear having teeth meshingly engaged with said rack teeth, said pinion gear being rotatable to impart movement of said elongate member along said longitudinal axis.

21. An apparatus for insertion into a body lumen, said apparatus comprising:

an elongate member having proximal and distal ends, said distal end comprising forceps including at least one clamping arm with a first end having a pivotal connection with said distal end of said elongate member, said at least one clamping arm extending away from said pivotal connection toward said proximal end of said elongate member; and

control means for controlling the pivotal movement of said at least one clamping arm relative to said elongate member.

22. The apparatus of claim 21 wherein said at least one clamping arm further comprises a second end opposite said first end, said at least one clamping arm being pivotal relative to said elongate member from a closed position to an open position, said second end of said at least one clamping arm adjoining said distal end of said elongate member when said at least one clamping arm is in said closed position, said second end of said at least one clamping arm being spaced from said distal end of said elongate member when said at least one clamping arm is in said open position.

23. The apparatus of claim 22 wherein said at least one clamping arm when in said open condition extends from said pivotal connection at an acute angle relative to a longitudinal axis of said elongate member toward said proximal end of said elongate member.

24. The apparatus of claim 21 wherein said forceps comprise clamping forceps for gripping an object, said at least one clamping arm including a plurality of teeth facing toward said distal end of said elongate member, said distal end including a plurality of teeth presented toward said plurality of teeth of said at least one clamping arm.

25. The apparatus of claim 21 wherein said forceps comprise cup forceps for cutting a tissue sample from within the body lumen, said at least one clamping arm comprising a first cup portion having a concave first receiving portion, said distal end of said elongate member comprising a second cup portion having a concave second receiving portion, said first and second receiving portions facing each other and forming between them a receptacle for receiving the tissue sample.

26. The apparatus of claim 21 wherein said at least one clamping arm comprises first and second clamping arms disposed on opposite sides of said elongate member.

27. Apparatus for supporting an instrument for insertion into a body lumen, said apparatus comprising:
an outer frame supportable relative to the body lumen;
an inner frame connected to said outer frame, said inner frame being rotatable about a first axis relative to said outer frame; and

an advance assembly connected to said inner frame, said advance assembly being pivotable about a second axis relative to said inner frame, said second axis extending perpendicular to said first axis, said advance assembly comprising a sleeve for receiving said instrument and advancing means operative to impart advancement of said instrument in opposite directions along a longitudinal axis of said instrument.

28. The apparatus of claim 27 wherein said advance assembly further comprises first and second clamping members that form said sleeve for receiving said instrument, said advance assembly further comprising a locking mechanism operative to place said advance assembly in a locked condition wherein said clamping members clamp onto said instrument to fix the position of said instrument relative to said advance assembly, said locking mechanism being further operable to place said advance assembly in an advancing condition wherein said instrument is released for movement relative to said advance assembly along said longitudinal axis of said instrument.

29. The apparatus of claim 27 wherein said advancing means comprises a rack and pinion gear set for imparting movement of said instrument along said longitudinal axis, said rack and pinion gear set comprising a series of rack teeth arranged along an outer surface of said instrument and a pinion gear having teeth meshingly engaged with said rack teeth, said pinion gear being rotatable to impart movement of said instrument along said longitudinal axis.

30. The apparatus of claim 27 wherein said instrument comprises:

an elongate member having a proximal end and a distal end, said distal end being insertable into the body lumen;

at least one clamping arm pivotably mounted at said distal end of said elongate member for pivotal movement relative to said elongate member, said at least one clamping arm having a closed position in which said at least one clamping arm adjoins said elongate member and an open position in which a portion of said at least one clamping arm is spaced away from said elongate member; and

control means for controlling the pivotal movement of said at least one clamping arm between said closed position and said open position, said control means being operatively connected with said at least one clamping arm.

31. A method for placing a stent within a body lumen, said method comprising the steps of:

providing an instrument comprising an elongate member, at least one clamping arm including a first end having a pivotal connection with a distal end of said elongate member, said at least one clamping arm extending away from said pivotal connection toward a proximal end of said elongate member, said least one clamping arm being actuatable between an open position and a closed position;

providing a radially expandable stent having an inner lumen;

sliding the stent over the distal end of the elongate member;

clamping a leading end of the stent between the at least one clamping arm and the elongate member by actuating the at least clamping arm to the closed position;

inserting the distal end of the elongate member into the body lumen and pulling the stent clamped thereto to a desired placement location;

actuating the at least one clamping arm to the open position, which thereby releases the stent for radial expansion into engagement with the body lumen;

advancing the distal end such that the at least one clamping arm clears the stent;

actuating the at least one clamping arm back to the closed position; and

removing the distal end of the elongate member from the body lumen by pulling the distal end and the at least one clamping arm back through the inner lumen of the stent.

32. The method of claim 31 wherein said step of actuating the at least one clamping arm includes the step of actuating a control mechanism located at a proximal end of the elongate member, the control mechanism being operatively connected with the at least one clamping arm by a connecting member.

33. The method of claim 31 wherein said step of clamping the stent includes the steps of:

actuating the at least one clamping arm to its open position;

sliding the stent distally into a receptacle formed at the distal end of the elongate member by the at least one clamping arm in its open position; and

actuating the at least one clamping arm to its closed position to thereby clamp the stent between the at least one clamping arm and the elongate member.